

recording density adjustment means for subjecting the area of each of the reference dots read by the reference dot reading means and a predetermined reference value to a comparison to adjust the recording density in such a manner that the difference is smaller than a predetermined threshold value; and

recording means for recording a dot code corresponding to multimedia information in accordance with the recording density adjusted by the recording density adjustment means.

Thus, dots can stably be recorded in such a manner that the area of the binarized dot is made to be predetermined reference value.

(39) An information recording apparatus for recording multimedia information including at least any one of audio information, image information and digital code data in the form of a dot code which can optically be read, comprising:

reference dot recording means for recording at least two or more types of reference dots having different recording densities;

reference dot reading means for dividing a picked up screen in such a manner that only one reference dot recorded by the reference dot recording means is included in a divided region and binarizing each divided region to read the reference dot to binarize the reference dot;

density selection means for subjecting the area of each reference dot read by the reference dot reading means and a predetermined reference value to a comparison and for selecting the density of the reference dot having the difference smaller than a predetermined threshold value; and

recording means for recording a dot code corresponding to multimedia information in accordance with the recording density selected by the density selection means.

Even if dots having different densities are recorded on the same information recording medium, optimum density can be selected.

(40) An information recording apparatus for recording multimedia information including at least any one of audio information, image information and digital code data in the form of a dot code which can optically be read, comprising:

input means for inputting information relating to the information recording medium;

storage means for storing the relationship between information relating to a predetermined information recording medium and one of the area of the dot when data is recorded and the recording density; and

means for reading corresponding one of the dot area and the recording density from the storage means in accordance with information input by the input means and relating to the information recording medium so as to record a dot code corresponding to multimedia information in accordance with the one of the dot area and the recording density.

Trial printing is not required to record information with appropriate recording density or dot area.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, and representative devices shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

I claim:

1. An information reproducing system comprising:

code reading means for reading a desired dot code from an information recording medium on which multimedia information including at least any one of audio information, image information and digital code data has been recorded in the form of a dot code which can optically be read;

binarizing means for generating binarized data from an image signal corresponding to the dot code read by said code reading means; and

information reproducing means for restoring binarized data generated by said binarizing means to original multimedia information to reproduce multimedia information, wherein

said binarizing means includes:

reference dot detection means which binarizes the image signal with a predetermined threshold value prior to generating binarized data so as to detect a reference dot from the binarized code image;

dot area measuring means for measuring the area of the reference dot detected by said reference dot detection means;

threshold value modifying means for modifying the threshold value in such a manner that the area measured by said dot area measuring means approaches a predetermined target value; and

threshold value determining means for binarizing the image signal with the threshold value modified by said threshold value modifying means.

2. An information reproducing system according to claim

1, wherein said binarizing means binarizes the image signal read by said reading means in one of field and frame units.

3. An information reproducing system according to claim

1, wherein

said code reading means successively reads the code image, and

said binarizing means modifies the threshold value of the successive image signals read by said reading means in one of the previous field and previous frame in accordance with the area of the detected reference dot so as to binarize the one of the present field and present frame with the modified threshold value.

4. An information reproducing system according to claim

1, wherein the reference dot is one of a data dot and an insulated dot having substantially the same size and same shape as those of the data dot.

5. An information reproducing system according to claim

1, wherein the dot code recorded on said information recording medium includes a data code corresponding to multimedia information and a pattern code for determining the position at which the data code is read, and

the reference dot is at least a portion of the pattern code.

6. An information reproducing system according to claim

5, wherein

said dot area measuring means includes:

dot interval measuring means for measuring the distance between predetermined dots forming the pattern code; and

area correction means for correcting the area of the reference dot or the target value in accordance with the interval between dots measured by said dot interval measuring means.

7. An information reproducing system according to claim

1, wherein

said reference dot detection means detects a plurality of reference dots; and

said dot area measuring means has average area calculating means for calculating the average area of the detected plural reference dots.

8. An information reproducing system according to claim 7, wherein

said dot area measuring means has dot selection means for inhibiting input of the area of the reference into said average area calculating means in a case where the measured area of each reference dot is larger than a predetermined range.

9. An information reproducing system according to claim 1, wherein

said threshold value modifying means has threshold value holding means for counting the number of reference dots detected by said reference dot detection means, determines whether or not the counted number of the reference dots satisfies a predetermined number and inhibits modification of the threshold value in a case where the counted number of reference dots is less than the predetermined number.

10. An information reproducing system according to claim 1, wherein

said threshold value modifying means includes;  
peak value detection means for detecting the maximum value and the minimum value of the luminance from a predetermined detection region;

interior division ratio modifying means for modifying the interior division ratio in accordance with the amount of modification of the interior division ratio calculated from the difference between the area measured by said dot area measuring means and the predetermined target value; and

threshold value calculating means which divides the value detected by said peak value detection means with the interior division ratio modified by said interior division ratio modifying means so as to calculate the threshold value.

11. An information reproducing system according to claim 10, wherein said peak value detection means interrupts following processes for the image signal for a subject frame in one of a case where detected minimum value is larger than a predetermined first threshold value and a case where the detected maximum value is smaller than a predetermined second threshold value.

12. An information reproducing system according to claim 10, wherein said peak value detection means has selective average calculating means for calculating the absolute value of the difference between pixels adjacent to a pixel of interest and for calculating the average value of the adjacent pixels only when a result of the calculation is smaller than a predetermined threshold value so that the peak values are detected from the average value of the calculated luminance.

13. An information reproducing system according to claim 10, wherein said interior division ratio modifying means has an interior division ratio modification amount table for determining the amount of modification of the interior division ratio in accordance with the relationship between dot area  $S$  and target value  $S_0$ , so as to determine amount  $\Delta k$  of modification of the interior division ratio from the measured dot area and the predetermined target value in accordance with said interior division ratio modification amount table.

14. An information reproducing system according to claim 10, wherein said interior division ratio modifying means calculates the amount  $\Delta k$  of modification of the interior division ratio by using a predetermined coefficient

$\alpha$ , the dot area  $S$  and the target value  $S_0$ , in accordance with the following equation:

$$\Delta k = \alpha(S_0 - S).$$

15. An information reproducing system according to claim 14, wherein the predetermined coefficient  $\alpha$  is made to be one of the same and smaller whenever modification is repeated.

16. An information reproducing system according to claim 10, wherein said interior division ratio modifying means changes the interior division ratio in a stepped manner and provides a hysteresis characteristic.

17. An information reproducing system according to claim 10, wherein said interior division ratio modifying means has interior division ratio limit means which determines whether or not the modified interior division ratio is in a predetermined range to clip the interior division ratio in a case where the interior division ratio is out of the predetermined range.

18. An information reproducing system according to claim 10, wherein

said reference dot detection means detects a plurality of reference dots, and

said interior division ratio modifying means has interior division ratio holding means for counting the number of the detected reference dots, for determining whether or not the counted number satisfies a predetermined number and for inhibiting modification of the interior division ratio in a case where the counted number does not satisfy the predetermined number.

19. An information reproducing system according to claim 10, wherein

said reading means successively reads the code images,

said interior division ratio modifying means modifies the interior division ratio to one of a field and a frame which satisfies a predetermined condition for the successive image signals read by said reading means and holds the modified interior division ratio for one of the following field and frame.

20. An information reproducing system according to claim 1, wherein

the dot code recorded on said information recording medium has an attitude dot disposed in a predetermined region adjacent to the reading start end and including information about said information recording medium for determining the threshold value required by said binarizing means,

said binarizing means includes:

attitude dot detection means for detecting the attitude dot;

attitude reading means which binarizes the image signals read by said reading means in one of field and frame units so as to read information relating said information recording medium from the attitude dot of said binarized image detected by said attitude dot detection means; and

attitude storage means for storing information read by said attitude reading means and applying information to each of following images.

21. An information recording medium for use in an information reproducing system having code reading means for reading a desired dot code from an information recording medium on which multimedia information including at least any one of audio information, image information and digital code data has been recorded in the form of a dot code which can optically be read; binarizing means for generating

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binarized data from an image signal corresponding to the dot code read by said code reading means; and information reproducing means for restoring binarized data generated by said binarizing means to original multimedia information to reproduce multimedia information, said information recording medium comprising:

data dots which correspond to the contents of multimedia information and which can optically be read; and

a reference dot arranged to be detected by said binarizing means and serving as a reference when the threshold value is modified to allow the area of the detected dot to approach a predetermined target value.

22. An information recording medium according to claim 21, wherein a plurality of the reference dots are recorded in an image pickup region.

23. An information recording medium according to claim 21, wherein said information recording medium has dot interval measuring dots for measuring a dot interval for correcting at least one of the area of the reference dot detected by said binarizing means and the predetermined target value.

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24. An information recording apparatus for recording multimedia information including at least any one of audio information, image information and digital code data in the form of a dot code which can optically be read, comprising:

input means for inputting information relating to said information recording medium;

storage means for storing the relationship between information relating to a predetermined information recording medium and one of the area of the dot when data is recorded and the recording density; and

means for reading corresponding one of the dot area and the recording density from said storage means in accordance with information input by said input means and relating to said information recording medium so as to record a dot code corresponding to multimedia information in accordance with the one of the dot area and the recording density.

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